

*With the Compliments
Benj. Westbrook*
al

PNEUMATIC DIFFERENTIATION.

PROCEEDINGS OF THE MEDICAL SOCIETY OF THE
COUNTY OF KINGS,

BROOKLYN, N. Y.,

February 16 and March 16, 1886.

THE THEORY OF THE PNEUMATIC CABINET. By J. KETCHUM.

SIXTY-NINE CASES TREATED BY THE PNEUMATIC CABINET.

By SIDNEY A. FOX, M. D.

PNEUMATIC DIFFERENTIATION. By BENJ. F. WESTBROOK, M. D.

THE PRACTICAL APPLICATION OF THE PNEUMATIC CABINET. By ISAAC H. PLATT, M. D.

WITH DISCUSSION.



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THE THEORY OF THE PNEUMATIC CABINET.*

By JOSEPH KETCHUM,

BROOKLYN.

THE investigation and experiments of which the pneumatic cabinet is the result have demonstrated a few facts which, thoroughly comprehended, will, to a certain extent, explain the clinical results reported by Dr. Fox and others. It would seem as if the ingenuity of all former investigators had been devoted to the production of sprays, mists, and fogs of varying degrees of tenuity, regardless of the surrounding physical conditions which must be invoked to produce topical application. As well might one inclose a valuable drug in an insoluble capsule and expect results as to introduce a fluid medium in vapor into an intrapulmonary space and disregard the physical laws which govern the return to its liquid condition.

Let us suppose, for example, that a normal tranquil inspiration requires twenty cubic inches of air. Now, if the barometer stands at thirty inches and the temperature is, say, 70° F., our twenty cubic inches will contain, by the tables of Professor Guyot and Professor Plantimore, about

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six one hundredths of a grain of water. Let us suppose that it is charged to this limit with moisture (and no method of atomization, however ingenious, can exceed this), and thus charged is inspired into the lungs. The agency of temperature asserts itself, and the pulmonary heat is imparted to the tidal air until it reaches, say, 90° F. Its physical condition has been changed, and its hygrometric capacity now not only includes the six one hundredths of a grain with which we loaded it, but, in addition, it absorbs eight one hundredths of a grain more from its moist mucous environment, and it is expired with fourteen one hundredths of a grain into the atmosphere. This excess of moisture in air on expiration over inspiration is demonstrated by the condensation of the excess of moisture on a frosty day, and is estimated by Valentine to be 8,100 grains a day. It may be urged that, in addition to the actual vapor capacity of air, sufficient may be added, in a state of high mechanical subdivision, to effect the purpose, and, to a certain limited extent, this is true; but it has been demonstrated that something more than the inspiratory act is required to introduce this mechanical fog farther than the smaller bronchi. Compressed air was tried by Waldenburg and others; but it was discovered that compression, the very agency used, so reduced the vapor-carrying capacity of the air that condensation took place at the moment of meeting, and condensation on the cell-walls was as far off as ever. Now, with the investigations and experience of old and well-known authorities before us, we find that neither inspiration nor pressure will directly introduce artificially moistened air into an alveolar space, except through the slow process of diffusion, and aspiration must be resorted to in order to get the saturated air to the locality where we wish to condense it. To produce the latter phenomenon, physics affords but two methods—viz., decrease of temperature and

increase of pressure. The temperature we can not change, nor would the lungs tolerate any such interference, and, as a last resort, we are compelled to use pressure. We are here aided by anatomical structure and physiological law, for, while in inspiration the glottis is opened to its fullest extent, on forced expiration, such as is produced by the cabinet, it is constricted to less than one half its area, and proportionate force must be employed to expire a given quantity of air in the same time in which inspiration was effected through an aperture of three quarters less capacity than that through which it entered. Recent tests have shown that a pair of lungs of two hundred cubic inches air-capacity, with a normal tidal flow of twenty cubic inches, will, when aspirated by a surrounding vacuum equal to one inch of the manometer, inhale at each inspiration one hundred cubic inches, or 50 per cent. of their total capacity. This prepares us for the following comparison: Instead of the tidal air of twenty cubic inches robbing the lungs of eight one hundredths of a grain of moisture at every respiration, we have one hundred cubic inches of air introduced at 70° F., containing three tenths of a grain of medicine, which is increased by seven tenths of a grain of pulmonary moisture due to its increase in temperature to 90° F., making our one hundred cubic inches contain one grain of solution. This solution consists of medicament three tenths of a grain, and moisture taken from the bronchial and alveolar surfaces seven tenths of a grain. During the act of respiration, and including the moment of rest preceding expiration, the atmospheric pressure has not been changed. But the act of expiration begins, and the volume of air about to be expired, weighing one thirtieth of an atmosphere more than the surrounding medium, is compressed by the contraction of the respiratory muscles, and condensation throughout the pulmonary structure is effected exactly as

the pressure lowers the hygrometric capacity of the tidal column. This, at the difference of one thirtieth of an atmosphere, or one inch of the manometer, as noted, reduces the physical capacity of our one hundred cubic inches of tidal air to six tenths of a grain, and the excess of four tenths is deposited on the nearest cell-walls.

The four tenths of a grain of condensate consists of 30 per cent. of medicine, or twelve hundredths of a grain, at each respiration, and, at eighteen respirations a minute, this would be two and sixteen hundredths grains. Consequently, in a sitting of fifteen minutes, thirty-two and four hundredths grains of medicine would be condensed upon the aërating septa of the lungs.*

An important condition in effecting condensation is the reversal of the physiological act of respiration. Normal inspiration is active, while expiration is passive. In the cabinet the reverse is the case.

If a piston pump is kept at the pulmonary temperature, and saturated air at 70° F. is aspirated into it by the *active* withdrawal of the piston, and it is then allowed to empty itself by the *passive* fall of the same, due to its weight, which must only suffice to overcome friction, no condensation is effected, and a weighed quantity of water contained in the pump will lose weight in the proportion previously stated; but let the pump be filled by *passive aspiration*, and the saturated air expelled by an active fall of the piston, equal to the forced expiration observed in the cabinet, and our weighed quantity of water will increase in weight at a rate that verifies the above-stated equation.

Clinical experience and experiment must determine to which of the agents—pulmonary calisthenics, topical medica-

* These deductions are calculated for the vapor of water, and must be corrected for density and tension if applied to other fluids or chemical combinations in use.

tion, stimulated arterial circulation, or thorough ventilation of the blood—are due the results which have been attained. Topical medication was the goal toward which the projectors devoted their energies, and, that having been accomplished, it remains for the investigators of the medical profession to determine the range and application of the cabinet as a therapeutic agent.

171 GATES AVENUE, BROOKLYN.

A REPORT OF
SIXTY-NINE CASES OF LUNG DISEASE
TREATED WITH THE PNEUMATIC CABINET.*

BY SIDNEY A. FOX, M. D.,

BROOKLYN.

My purpose is to present this evening a simple record of personal experience with the pneumatic cabinet. The province of this report will not include the physics of pneumatic differentiation, or any questions of pathology, but merely the results of clinical investigation during a period of thirteen months. I would avoid any misconception which might be involved in the title of this paper by saying that, in every chronic case, treatment with the cabinet has been supplemented by the course of tonic treatment usually employed, including cod-liver oil and hypophosphites. Night-sweats have been controlled, as far as possible, by different therapeutic agents, notably quinine, and a combination of the oxide of zinc and the extract of belladonna. In checking diarrhœa, the different preparations of opium and bismuth, either alone or in combination, have been most effective.

I would call the attention of those who may desire to

* Read before the Medical Society of the County of Kings, February 16, 1886.

further investigate the subject of pneumatic differentiation to the following articles, which represent the published literature to date.

H. F. Williams, M. D., "Antiseptic Treatment of Pulmonary Diseases by Means of Pneumatic Differentiation," "Medical Record," January 17, 1885; "Pneumatic Differentiation," "N. Y. Medical Journal," October 5, 1885.

V. Y. Bowditch, M. D., "Boston Medical and Surgical Journal," July 16, 1885, and "Journal of the American Medical Association," August 1, 1885.

A. F. Houghton, M. D., "Journal of the American Medical Association," November 7, 1885.

Dr. Jensen, same journal and date as Dr. Houghton's article.

Joseph Ketchum, Esq., "The Physics of Pneumatic Differentiation," "Medical Record," January 9, 1886.

E. Darwin Hudson, Jr., M. D., "Present Status of the Pneumatic Treatment of Respiratory Diseases," "Medical Record," January 9, 1886.

Two years ago last January, while convalescing from an attack of acute lobar pneumonitis, one of the physicians attending me, my esteemed friend Dr. H. F. Williams, casually remarked that he had an apparatus which promised to mark a new departure in the treatment of lung diseases. That was my first introduction to the pneumatic cabinet. At that time there was no literature on the subject extant, and pneumatic differentiation was practically unknown. Through the kindness of Dr. Williams and Mr. Ketchum, I was permitted to see the patients treated, and to note their progress from time to time. My conviction as to the utility of the cabinet was, in a short time, thoroughly established. Any doubts which may have lingered in my mind have been completely dissipated in the treatment of the sixty-nine cases of lung disease which have come under my care

since February, one year ago. I think I can say, without fear of contradiction, that the results in some of these cases have been remarkable.

Following are the results:

	No. of cases.	Recov- ered.	Im- proved.	Non-im- proved.	Deaths.
Asthma.....	1	.....	.....	1	.....
Bronchitis, acute.....	23	23	.....	.....	.....
Bronchitis, chronic.....	1	1	.....	.....	.....
Chronic bronchitis, emphysema, and asthma.....	5	1	2	2	.....
Pneumonitis (unresolved).....	3	2	1	.....	.....
“ (chronic interstitial).....	1	.....	1	.....	.....
Pyothorax.....	1	.....	.....	.....	1
Phthisis.....	34	.....	17	10	7
Total.....	69	27	21	13	8

This table, it may be well to say, contains every case that has come under my care. There has been no selection of brilliant results or suppression of bad ones, for the sake of a general effect. The whole truth has been told.

It is confessedly difficult to tabulate satisfactorily a large number of cases from private practice. Some of my patients were residents in other States, and, upon improvement, they usually became restless and anxious to return home. Some moved away from the city, and others did not find the treatment satisfactory, and gave it up before any result could reasonably be expected. I mention these as a few of the obstacles that have, in some degree, thwarted a fair investigation. They may also suggest reasonable explanations of failure in those cases in which no improvement was perceptible.

The first case in the list of statistics, considered alphabetically, is one of asthma. No improvement was noted. The patient was a large, obese man, of German parentage,

who had been subject to paroxysms of asthma for several months. Two sittings only, at an interval of two days, were given, and a solution was used consisting of the extract of pine needles, tincture of iodine, glycerin, and water, to each ounce of which a drachm of the tincture of hyoseyamus was added. The time consumed in the two treatments was, respectively, five and ten minutes. The amount of vacuum used was 0·8 of an inch of mercury, representing $\frac{2}{3}$ of an atmosphere. The patient experienced no benefit, and the treatment was discontinued. It is interesting to note that a change of residence from New York city, where the patient had resided for years, to Rochester, N. Y., afforded complete relief while he remained in that city; but, on returning to New York, the paroxysms were renewed with all their severity.

Of the twenty-three cases of acute bronchitis but little need be said. All were easily cured by using the solution already referred to, or a solution of the bichloride of mercury of a strength of 1 to 800. To the latter solution glycerin was added to allay the irritation caused by the bichloride. The smallest number of treatments given in any case was one, and the largest ten. The amount of vacuum employed varied from 0·2 to 0·8 of an inch of mercury. We all know that the prognosis in acute bronchitis in the adult is, as a rule, favorable, and that most patients would recover without any treatment; but we must remember how quickly cases can be cured by the cabinet, and how great the relief afforded even by the first treatment. Obstinate cases of acute bronchitis, which have resisted the old forms of treatment, yield readily to the cabinet treatment. The moderate expansion of the lungs relieves the constriction complained of in bronchitis, and the spray soon causes an abundant expectoration. The latter is accomplished without the aid of those disgusting compounds known as "cough mixtures,"

and usually composed of medicines which are apt to nauseate, to take away the appetite, and to cause constipation and cephalalgia. No less important authority than Professor Austin Flint, Sr., in speaking of expectorants, says: "They are of doubtful efficacy, and, if not useful, are more or less hurtful." (See Flint's "Practice of Medicine," p. 221.) Squills, ipecac, syrups, and opiates belong to the relics of by-gone days.

The last and greatest benefit of this treatment in this class of cases is the vacuum, by means of which partially collapsed air-cells are distended. The physical exercise develops the lungs and chest, and, in some cases, increases the expansion as much as two or three inches, thus strengthening the lungs and warding off subsequent attacks. If these results can be obtained by any other treatment than that of the cabinet, I am ignorant of the method.

One case of chronic bronchitis is reported, and a cure is noted. Twenty-eight treatments, extending over four months, were given, and from 0.6 to 0.8 was the amount of vacuum employed. The iodine and pine solution was the spray used.

Of the three cases of chronic or unresolved pneumonia treated, there were two recoveries and one improvement. These cases are very interesting, and for the histories of two of them I am indebted to my associate, Dr. D. R. Brown:

CASE I.—Mr. K., aged twenty-two, clerk, unmarried. (Referred by Dr. H. F. Williams.) In February, 1885, developed acute lobar pneumonitis of lower lobe of left lung. He came to the office in April, so weak that he had to ride in a carriage. He was examined by the late Professor Samuel G. Armor and Dr. Williams, who found him very much emaciated, with a feeble and rapid pulse. There was small expansion in the left side. Below the scapula there were marked dullness and bronchial respiration, with râles above. Weight 109½ pounds. Diagnosis, unresolved pneumonia. Dr. Armor made a very unfavor-

able prognosis. Treatment began April 14th with 0.4 vacuum. Inhalations to occupy ten minutes each day. After the first treatment the lips looked redder; lungs were more fully expanded.

April 18th.—Complains of soreness about the chest.

20th.—Thinks he was better yesterday than he has been at all since the beginning of his illness in February.

21st—Yesterday raised nearly a pint of "greenish material." Moist râles have appeared in lower part of left lung.

23d.—Weight 110½ pounds. Feels pretty well.

May 5th.—Daily treatments to date. Continued improvement in symptoms. Walks from his residence in Lexington Avenue to his office in Vanderbilt Avenue. Weighs 112½ pounds.

20th.—Favorable progress has continued. Desires to discontinue treatment. There is entire cessation of symptoms, appetite is good, looks well and feels well. Weight 116½ pounds. Has taken twenty-seven treatments in as many days. Subsequent examination by Dr. Armor shows slight dullness below scapula, but much less than formerly; respiratory murmur over that portion of the lung. There are no moist râles. A later report from Dr. Williams says the case is entirely cured.

Case II.—Mr. E. This man came to Brooklyn, accompanied by Professor H. L. Bowditch, April 3, 1885. The following is his history: Had an attack of acute lobar pneumonitis in May, 1884; lower lobe of left lung affected. Has never fully recovered his health; there is persistent though not violent cough, with some expectoration. Is short of breath, with a feeling of constriction about the chest. Has spent some time in California and the Yosemite Valley, but without relief of symptoms. Was about to start for Florida when he consulted Dr. Bowditch, who advised the treatment pursued. Physical examination showed slight consolidation at the base of the left lung, with crackling râles over seat of consolidation. Diagnosis, unresolved pneumonia. First treatment April 3d. Iodine and pine solution, 0.4 vacuum; time employed, ten minutes. Sense of constriction entirely relieved and did not return. After three treatments Mr. E. returned to Boston, believing himself cured,

April 30th.—Returns at the suggestion of Dr. Bowditch, dry râles being present over lower lobe of left lung. Chest painted with tincture of iodine.

May 4th.—Daily treatment, 0.4 vacuum, ten minutes' duration. Chest painted with iodine every day. Feels well; increased expansion. Put upon syrup of hydriodic acid, 3 j, t. i. d.

16th.—Treatments discontinued. Weight 171½ pounds, this being an increase of 1¾ pounds over best previous weight. Feels perfectly well; evidence of consolidation absent. Slight friction murmur found. An extract from a letter received from Mr. E. October 8, 1885, six months after he was discharged, says: "I have been very well since I left Brooklyn last May. Have not had any trouble with my breathing as I had last winter."

CASE III.—Was referred to me, at the suggestion of Professor Armor, by his family physician, Dr. Samuel P. McIlroy, of Degraw Street. A physical examination showed consolidation at base of right lung as evidenced by dullness on percussion and bronchial breathing.

Five treatments were given, extending from July 25 to August 11, 1885. Patient's general condition was improved; breathed freer, and expansion of the chest was increased one inch and a half. The weather being quite warm and patient improved, he was advised to go to the Catskill Mountains for the remainder of the hot term. This case is reported as improved.

Experience from various quarters will warrant the prediction that the cabinet will become known as a specific for *recent cases* of this class.

CASE IV.—Mr. D. (Referred by Dr. Z. T. Emery.) Family history negative.

Personal history: Age twenty-eight years, married, manufacturer. Best weight 159 pounds, present weight 132 pounds. In 1878 had pneumonia, involving the right lung. Has had more or less cough ever since, with considerable expectoration; appetite is poor; has lost flesh and strength. Says that he "burst a blood-vessel" in 1879; on this occasion he lost an "immense quantity" of blood, the hæmorrhage continuing for two days.

Four years ago had some night-sweats. Spent the last winter in Nassau and Thomasville, Ga., with benefit; gained in weight from 127 to 140 pounds, and felt generally better. Last fall, when he began to fail again, he consulted Dr. Emery as to the advisability of permanent residence in another climate, and by him was referred to me for treatment. He came complaining of severe stitch pains in the right side, troublesome cough and expectoration, and general failure in health. Physical examination shows increased frequency of respiration, with restricted movements on the right side. Dullness over lower lobe of right lung, with tubular breathing, accompanied by moist bronchial râles. Diagnosis, chronic interstitial pneumonia. Treatment begun October 4, 1885, 0.6 vacuum for ten minutes. The first treatment entirely and permanently relieved the stitch pains, which had been so severe that he had been unable to take a "full breath" for months. I quote his words. After thirteen treatments, extending over a period of two months, the patient's weight had increased to 139 pounds, and there was complete abatement of symptoms. Since November 30th he has presented himself at weekly intervals, fearing that entire suspension of the treatment will be followed by a return to former conditions. Physical examination February 16th shows resonance over the whole right lung, with normal vesicular murmur. There are no râles. He weighs 141 pounds. Chest measure has increased two inches since October 4th.

Five cases of chronic bronchitis, associated with more or less emphysema and asthma, were treated with the following results: One patient was cured, two *greatly* benefited, and two remained unimproved. A succinct history of the case of complete recovery is kindly furnished by Dr. Brown, and is as follows:

Mr. M., aged forty-five, manufacturer. Family history negative. Personal history, three months ago contracted a severe cold. Has been coughing ever since, with considerable expectoration. Is short of breath, and is subject to distinct paroxysms of asthma.

Physical examination : Inspection shows a well-nourished man with a finely developed chest.

Percussion : Increased resonance, vesiculo-tympanitic in quality.

Auscultation : Sibilant and sonorous râles so audible as to be heard without applying ear to the chest.

Diagnosis, chronic bronchitis, emphysema, and asthma.

Treatment : Spray of iodine and pine, and tincture of hyoscyamus, 0·6 vacuum ; time, ten minutes. Compound syrup of hypophosphites in 3j doses after each meal. Took treatment for an interval of a week every other day. Was discharged entirely relieved.

Of the two patients in whom no improvement was noted, one voluntarily discontinued the treatment after the first sitting ; in the other, such distressing paroxysms of asthma were caused by the spray that a discontinuance of the treatment was advised both by Dr. Williams, who kindly referred the case to me, and myself.

Lastly comes the consideration of phthisis. Of the thirty-four cases recorded, seventeen are reported as improved and ten not improved ; the deaths amounted to seven. You will notice that I have refrained from reporting any cases of phthisis as cured. It is difficult to say when a case of phthisis *is* cured. Of the seventeen cases noted as improved, in fourteen, nearly one half the entire number reported, the disease was arrested. By arrested I mean that the phthisical process, so far as could be determined by physical signs, was at a stand-still. The patients increased in weight—one as much as seventeen pounds—cough and expectoration almost entirely or completely disappeared, appetite and sleep became natural, and in several instances the parties returned to their usual vocations.

For the subjoined reports of individual cases of phthisis we are again indebted to Dr. Brown, with whose remarks I fully concur.

CASE I.—A young married woman, no children. Family history negative. Illness began with a severe attack of Roman fever contracted while in Rome. She was brought to New York in bed. Examination soon after her arrival revealed a softened condition of the right lung. Under medical advice she gained strength sufficient to make a trip to southern California, where she remained several months, but without benefit. Then she visited the more prominent health resorts. Finding that the disease remained unchecked, she returned to Brooklyn, and, by the advice of Dr. A. W. Catlin, of this city, began a course of treatment in the pneumatic cabinet. At this time, December 28, 1884, she presented conditions as follows: Pale and anæmic, marked blueness of the extremities, stub nails, respiratory movements feeble. Physical examination revealed infiltration extending throughout the right lung, with a cavity in the upper portion in a state of activity. This diagnosis was confirmed by Professor A. L. Loomis, of New York, and Dr. Herbert F. Williams. Treatment began December 28, 1884; vacuum 0.3. Respirations in cabinet to continue five minutes.

29th.—Slept well last night.

31st.—Claims great relief.

January 2, 1885.—Vacuum increased to 0.5. Patient to have two applications made daily—half an hour apart.

3d.—Appetite improved.

5th.—Continued improvement, according to patient's account. Has slept lying on the right side for the first time since last spring.

8th.—Vacuum 0.4 for fifteen minutes twice daily. Expresses herself as feeling "splendidly."

18th.—Her husband notices steady improvement in cough and general condition, and is annoyed at the unfavorable prognosis which prudence dictates in these cases.

20th.—Menses present; says that the discharge is more natural than it has been for many months.

February 1st.—Daily treatments since last note. Has been suffering from a "cold" during the last week; otherwise has done well. To-day was re-examined by Dr. Loomis, who finds increased expansion and better respiration, with marked im-

provement in the heart's action. Advises persistence in the treatment.

2d-26th.—Treatments administered every day during this interval. Vacuum has been maintained at 0·8 since January 8th for about twenty minutes altogether each day. Cough has been less violent and less frequent. Has slept uniformly well. On February 23d walked from Columbia Heights to office in Vanderbilt Avenue. Expresses herself as feeling generally more comfortable as the result of successive treatments.

March 14th.—Daily notes show favorable progress, especially a decrease in the severity of cough and amount of expectoration. To-day starts for a trip to Old Point Comfort.

25th.—Returns for treatment. On March 1st spat up a quantity of "flaky material." The effort was followed by considerable pain in the chest. During absence has enjoyed a good appetite; slept well, except for two or three nights past has been troubled with shortness of breath. She is glad to resume treatments.

April 3d.—Examined by Professor H. I. Bowditch, who concurs in the diagnosis and, in the light of past history, in the efficacy of treatment.

28th.—Daily treatments as heretofore. The patient has passed a comfortable month.

May 5th.—Symptoms very favorable. Patient has gained in every particular. Disease is apparently inactive. To-day she goes to Summit, N. J., for the summer. A cabinet is taken to her summer home and she passes into the hands of the local physician, under whose directions the treatment is continued.

15th.—Visited at Summit to-day. Is doing very well. Coughs and expectorates very little, and a physical examination discloses no moisture in the cavity.

20th.—Husband reports that she does not seem so well as usual, and that there is slight swelling about the ankles. Examination of urine shows the presence of albumin—about 25 per cent. Specific gravity 1·005. Patient died in August.

This patient took in all one hundred and seven treatments. Various remedial agents were employed for inhala-

tions, including the bichloride of mercury, iodine and pine, carbolic acid, iodoform, and tannic acid. You will appreciate the difficulty of condensing daily notes of phthisical symptoms into a readable clinical history, and, while this report is essentially a copy of these, an attempt has been made to sum up, under a comparatively few dates, prevailing subjective symptoms and results. As to these we are dependent on the testimony of patients belonging to a class whose morbid hopefulness, exalted by a novel therapeutic means, encourages false estimates of the amount of relief afforded. For this reason the results of examinations by Dr. Bowditch and Dr. Loomis, though not strictly coming under the head of clinical notes, have been included here. It may be added that in the discussion of a paper by Dr. H. F. Williams, read before the Climatological Association in May last, Dr. Loomis referred to this patient as one who had done very well under this treatment. She had a cavity in the lung, had been the world over for her health, had remained at home the past winter, and was much better than in the autumn.

The next case was as follows: Mr. S., referred by Dr. Williams. This case is noted briefly as showing the influence of the treatment over pulmonary hæmorrhage. The patient gave a history of frequent attacks of severe hæmoptysis which had resisted all ordinary measures. During respiration in the cabinet the *pressure* of the air within was increased by one fiftieth of an atmosphere, represented by a rise in the manometer of 0.6 of an inch. Beginning January 26th, has taken six treatments to date (February 5th), has increased in weight two pounds, and there has been no return of hæmorrhage.

Mr. C. (referred by Dr. W. H. Hazard, Peacedale, R. I.), aged thirty four, merchant, widower; best weight, 140 pounds; present weight, 115 pounds.

Family history: Three grand-aunts died of phthisis.

Personal history: Hæmoptysis seven years ago, and at intervals since that time. Dates the beginning of present illness from a cold contracted last fall. Had been troubled with a "hacking" cough for some weeks previously. In October cough increased in severity, and was accompanied by a profuse expectoration. There was considerable "soreness" of the chest on the right side. He noticed progressive loss of appetite, emaciation, and debility. Suffered from night-sweats and hoarseness. There was no diarrhœa.

Physical examination, November 29, 1885: Pulse 120, temperature 102°, at 10.30 A. M.

Inspection: A tall man, with narrow chest and shoulders, anæmic and pale, upper thorax on right side flattened and very slightly, if at all, movable on forced inspiration. Right shoulder depressed.

Percussion: Dullness in the supra-clavicular, clavicular, and subclavian regions, extending from apex of right lung to the third intercostal space, and from sternum to axillary line.

Auscultation: Throughout these regions are indeterminate râles, crackling and crumpling, with this exception, that, over a small area at the second intercostal space, there was cavernous respiration.

A microscopical examination, made during course of treatment, showed absence of the *Bacillus tuberculosis*.

Treatment was begun, on November 29th, with 0.4 of an inch vacuum, and a spray of a solution of iodine and pine of the strength usually employed. Cabinet respiration to continue for ten minutes daily.

December 4th.—Has had three treatments. Coughed a good deal since first sitting. Temperature 101°. Breathes freely and easily in the cabinet.

5th.—Temperature 99.37°, pulse 110. Cough less violent. Thinks that appetite has increased, and that he feels stronger. Full diet, with milk in quantity ordered. Vacuum increased to 0.8. He was put upon $\frac{3}{4}$ ss. doses of the following mixture before each meal: \mathcal{R} Tr. nuc. vom., \mathfrak{z} iij; tr. digitalis, \mathfrak{z} jss.; syr.

hypophos. co., ℥ iiij; maltine, ℥ viij; with ʒ j doses of Squibb's cod liver oil, to be increased to half an ounce and taken an hour after each meal. It should be noted that his family physician had prescribed cod-liver oil early in the history of the case, which, after repeated trials, he had been obliged to abandon on account of stomach disturbance. Since December 6th, that is, after five treatments, he has had no difficulty in retaining and assimilating this nutrient, and has taken it regularly in ℥ ss. doses up to the present time.

7th.—Pulse 100, temperature 99° . With the exception of one exacerbation of temperature to be noticed further on, his morning temperature has not risen above this point up to the time of writing (February 6th).

8th.—Weight $118\frac{1}{2}$ pounds.

11th.—Weight 119 pounds, temperature 102.4° , pulse 120. Feels weak; sweat a good deal last night; cough troublesome.

13th.—Temperature $100\frac{1}{4}^{\circ}$, pulse 118.

16th.—Weight $119\frac{1}{2}$ pounds. No night-sweats since the 12th. Appetite excellent; coughs less.

22d.—Weight 120 $\frac{1}{2}$ pounds, temperature 99° , pulse 110.

26th.—Weight $122\frac{1}{2}$ pounds. Continued improvement.

January 2, 1886.—Weight 125 pounds. Mixture ordered to be taken before meals omitted.

8th.—Spat a little blood yesterday. The only approach to a hemorrhage since pneumatic treatment was begun.

20th.—Weight $127\frac{1}{2}$ pounds. Thinks he is able to return to his business. Coughs only in the morning, and feels "first rate." Frequently goes to New York for pleasure, and takes daily walks about Brooklyn without unusual fatigue.

31st.—Weight $130\frac{1}{2}$ pounds.

February 6th.—Weight 132 pounds—within eight pounds of his best weight. Up to this date he had taken forty treatments in the pneumatic cabinet.

There has been almost uninterrupted improvement in the subjective symptoms in this case since the initial treatment in the Ketchum cabinet. Indeed, it is difficult to persuade the patient that he is not practically a well man. He is anxious to go home and resume his work behind the counter; thinks that

the slight morning cough will "wear off" if he is careful to avoid taking "cold." Physical examination made February 6th demonstrates the existence of a cavity near the base of the upper lobe of the right lung, with consolidation at apex. There was failure to detect râles of any kind in any part of the thoracic cavity.

To what shall the improvement in symptoms be attributed? And, if it is granted that a progressive increase in weight of seventeen pounds in a little more than two months is evidence that during this period the disease has been non-progressive, how may this inactivity be accounted for? A certain proportion of cases of pulmonic phthisis manifest an inherent tendency to recovery; it may be that the case in question suddenly developed this tendency, exemplifying remarkable coincidences. It is possible that change of environment had much to do with the abatement of symptoms, though the humidity of our atmosphere is not calculated to exert a favorable influence upon pulmonary disease. The fact that our patient has been able to digest and assimilate a generous diet, into which milk and cod-liver oil have entered largely, certainly has much to do with his gain in weight and strength. Such considerations as these might suffice to account for the unusual record which has been submitted were this an isolated history; but papers, by gentlemen to whom reference has been made, contain records that are entirely parallel, and the inference is unmistakable. It is a point worthy of emphasis that patients to whom cod-liver oil had been intolerable have taken it without difficulty when exhibited in conjunction with this special method of local treatment. Setting aside its value as a calisthenic exercise and as a means of making direct application to parts hitherto inaccessible, its influence on general nutrition, as evidenced by almost invariable increase in appetite and assimilative power following its use, warrants the

expectation that, in debilitated conditions generally, it will be found a powerful adjunct to the means commonly employed.

Of the seven cases of phthisis where death is reported, great temporary relief was afforded in nearly every instance by this treatment.

Over and over again have patients said to me, after having been told that they could not be cured, "Doctor, I would like to continue the treatment, because it makes me feel better, and you do not know what a relief it is to be able to take a deep breath." Of these seven patients with phthisis, two died of acute lobar pneumonitis, two of Bright's disease, in addition to the lung trouble, and only three of simple phthisis unassociated with any complication.

PNEUMATIC DIFFERENTIATION.*

BY BENJAMIN F. WESTBROOK, M. D., BROOKLYN,
PHYSICIAN IN CHIEF TO THE DEPARTMENT OF THORACIC DISEASES, ST. MARY'S
HOSPITAL; PRESIDENT OF THE BROOKLYN PATHOLOGICAL SOCIETY;
FELLOW OF THE AMERICAN LARYNGOLOGICAL ASSOCIATION, ETC.

THE subject of the physiological action and therapeutic application of the pneumatic cabinet is so extensive that one is at a loss as to what points it will be most useful to consider at this period of its history. I will simply endeavor to bring out some things which have been suggested by the papers of Dr. Williams, Dr. Fox, and Mr. Ketchum. Some months ago Dr. Platt and I obtained one of the cabinets for experiment, and have been using it constantly, though we have not treated so many cases as have Dr. Williams and Dr. Fox.

Our results have been about parallel to theirs, as far as we can judge, making allowance for difference of nomenclature, and the varying ideas of the diagnostic significance of physical signs among medical men.

The pneumatic cabinet must, in my opinion, be classed with other apparatus for the inhalation of or exhalation into condensed or rarefied air. It involves no new principle, and only differs from the Waldenburg method in that the patient sits in the apparatus and breathes the external air in-

* Remarks made before the Medical Society of the County of Kings, February 16, 1886.

stead of sitting in the open and breathing the air from the apparatus. It has the advantage of an unlimited supply of air, and of being more easily managed by the operator; though, as at present constructed, it is scarcely as manageable when we desire to change the pressure with the respiratory acts. As generally employed, the pressure is maintained, both during inhalation and exhalation, the patient sitting under a diminished pressure and both inhaling and exhaling into (relatively) compressed air.

What we do is to increase the expansion of the chest by diminishing the pressure on its exterior. At the same time that more air is inhaled, the tendency is, by pressure upon the respiratory surface, to exsanguinate the pulmonary capillaries and increase the amount of blood in the systemic vessels. By the introduction of a medicated spray or vapor, local treatment is applied to the upper air-passages. The expansion of the lung involves the inflation of any portions of it which are in a state of partial or complete collapse.

It also involves the further distension of any portions which may already be abnormally capacious—a point which will be referred to again in speaking of its application to special diseases.

There is, as far as I know, no very reliable information in regard to its effects upon the body at large, or upon the systemic circulation. We may, however, apply what is written of the Waddenburg apparatus in this respect to the cabinet. As for the local use of medicinal agents, I think that they can only be relied upon to affect the upper air-passages. Of course, a vapor, such as that of iodine, may diffuse into the residual air, and so reach the lobular structures, but it would get there just as certainly, and almost if not quite as rapidly, by way of the blood. We must distinguish, in our discussion of this subject, between vapors and sprays. The sprays are simply fluids, pulverized and

projected as far as possible into the respiratory passages. Whether they can be made to penetrate beyond the larynx, when thrown in through the breathing tube, is very doubtful. It certainly would be impossible for them to go beyond the trachea. We must not, then, depend upon sprays for disinfecting or otherwise treating the lobular structures. If that were desired, it could be better accomplished by means of the Sass apparatus and deep voluntary inspirations on the part of the patient. I can not accept Mr. Ketchum's doctrine that the air in the respiratory passages undergoes more compression during expiration when one is in the cabinet than when out of it. The extra amount of force exerted by the muscles of expiration is not used in compressing the air, but in overcoming the negative pressure on the surface of the body. It requires no unusual force to expel the air, as no obstacle opposes its exit from the respiratory tract. The idea that the glottis closes during expiration, and offers an obstruction to the outflow, is erroneous. In normal respiration the vocal bands do approach each other slightly during expiration, but any one who has watched the larynx with the laryngoscope will be unwilling to admit that the very slight, in many cases almost imperceptible, adduction of the vocal bands during expiration can offer any resistance to the outgoing air. I think that the text-books of physiology rather overstate the amount of closure of the glottis during expiration, and Mr. Ketchum has probably derived from them an exaggerated idea of the importance of this motion.

But, while the sprays are of no service for treating the pulmonary structures, they may be of decided utility in the management of catarrhs of the upper air-passages.

As concerns the treatment of special diseases, I will say that I think the best results may be obtained in bronchitis. This remark must apply to the subacute and

chronic forms. I confess that I have no experience with the cabinet in acute bronchitis. I have not recommended it to my patients, because those whose cases are not severe enough to remain at home are generally cured in two or three office visits, and the cabinet has not seemed necessary to their treatment. When, however, there is a tendency for it to become chronic, or when that character has already become established, the cabinet treatment has been very successful. This was my own experience when I returned from the Adirondacks last autumn with a bronchial cough and profuse mucopurulent expectoration. The vacuum treatment, combined with the inhalation of a tannin and carbolic-acid spray, had a most happy curative effect.

If emphysema is associated with the bronchitis, great care should be used, and the pressure made very light, lest the dilatation of the vesicles be increased.

The best method, theoretically, in such cases would be to allow the patient to inhale with a slight vacuum, and exhale under slight pressure. We have not thoroughly tested this method as yet, but we know, from the reports of Waldenburg, Oertel, and Cohen, that expiration into rarefied air has been followed by beneficial results in emphysema. With the latter disease, in typical cases, we have, as yet, little or no experience. The method just described would promise the best results.

The reports of treatment of cases of unresolved pneumonia should be made and received with great caution. It is very easy to make the error of calling an incompletely cured pleurisy an unresolved pneumonia. After the fluid effusion has been mostly or entirely reabsorbed, there may remain a considerable amount of fibrinous material between the pleural surfaces. The pleura is thick, and the subjacent lung incompletely expanded with hyperemia and a catarrh of the capillary bronchi. There is dullness on percussion,

and the expiration is more or less prolonged, while numerous small mucous râles are heard with inspiration and expiration. This may last for a considerable length of time.

The history of such cases should be carefully investigated, the presence or absence of bronchial breathing, and particularly of bronchophony, noted, and the temperature watched. Unresolved pneumonia of a lower lobe is a much less frequent lesion than the one alluded to. When it exists, the alterative action of differential pressure may be highly beneficial. Unresolved pleurisy is, by all writers on the subject, considered one of the diseases in which aërotherapy is most efficacious.

Chronic interstitial pneumonia is a disease the subjects of which may be greatly benefited by the pneumatic treatment.

It should, however, in this disease, be applied with the greatest caution, and only with a full understanding on the part of the operator of the pathological conditions present, and of what he expects to accomplish by the use of the cabinet.

It should be borne in mind that the affected portions of the lung are entirely destroyed as far as their breathing function is concerned, and that a restitution of the normal structure is out of the question. The spongy tissue of the organ is transformed into a solid fibrous mass. The air-vesicles are not collapsed, but completely obliterated, and no further expansion of this tissue can occur.

It will result from this that, if too great expanding force is applied, the non-consolidated portions will become emphysematous, dilating to fill the space which can not be occupied by the diseased parts, and the bronchiectatic condition will be aggravated. Nevertheless, if the treatment is carefully managed and the reduction of pressure about the body very slight, the bronchial catarrh may be

relieved, and the nutrition of the unaffected lung, and of the remainder of the diseased one, improved. We have had a very gratifying result in such a case, where one lung was rendered almost entirely useless for respiratory purposes by a chronic interstitial pneumonia.

In regard to phthisis pulmonalis, I believe that in the early stages of the disease the cabinet is capable of doing much good, and in many cases of arresting the morbid process.

We have seen recovery take place in one or two cases. Of course, the term recovery, in the sense of a disappearance of the physical signs with coincident restoration of the general health, can only be applied to cases that have not advanced beyond what we call an "apical catarrh," or "incipient phthisis." But, where the disease was further advanced and general health has been restored, with disappearance of hectic and of all local signs, except some dullness and altered respiratory sounds at the apex, it is proper to use the term *cured*. There may, of course, be a return of the disease at some future time, but that also occurs in the case of many other affections where we feel ourselves justified in speaking of recovery as having taken place. In some cases the disease may be rendered temporarily latent, and in others, in which, owing to the advanced stage which it has reached, no such result is to be hoped for, life may be prolonged for a few weeks or months. As to the method of treating these cases, particularly those that are far advanced, it has seemed to me that it would be better, if the patient's muscular strength is greatly reduced, to take off the pressure during the act of expiration, so as to relieve the expiratory muscles of the increased labor resulting from exhalation against a pressure. This would be equivalent to inspiration of compressed and expiration into normal air. Where the pressure is continued throughout both acts, the

fatigue with some patients is very considerable. My friend Dr. Platt does not, however, agree with this opinion, but treats such cases with a very low pressure, so as to avoid fatigue. He thinks that the continuous pressure is particularly useful, as it diminishes the pulmonary congestion and lessens the liability to hæmoptysis. This is undoubtedly true, but it may be that the resulting fatigue, with very weak patients, more than outweighs this advantage.

In addition to the danger of producing undue dilatation of alveoli and bronchiectatic cavities, it is supposed by some that there is also a risk of exciting hæmorrhage. I think, however, that the fear is ungrounded if the cabinet is properly used. It has rather a hæmostatic effect when used in the ordinary way—that is, by rarefaction of the air in which the patient sits. We have frequently used it for this purpose, putting patients whose sputum was bloody into the cabinet under a moderate pressure. When they emerged, the blood would have entirely disappeared from the expectoration.

When cavities exist, however, there may be danger of lacerating vessels which run in their walls. We have had two cases of profuse hæmoptysis coming on during a course of pneumatic treatment, but not while the patients were in the cabinet. In neither one can it be alleged that the treatment bore any causative relation to the hæmorrhage.

The first case was that of a man suffering from extensive fibroid induration of the left lung sequent to an attack of lobular pneumonia of the upper lobe. He suffered greatly from dyspnea and had periods of febrile movement, sometimes lasting for a month. During one of these periods he was subjected to treatment by a low vacuum, one sixtieth of an atmosphere. After three or four trials, he came around one morning and complained of feeling worse. He was very short of breath and had great constriction and oppression of the chest. Dr. Platt did

not put him into the cabinet. He went from the office to New York, and, while returning on the ferry-boat, began to raise blood. He went into a drug-store, and says that he nearly filled a cuspidor with blood. After resting a few minutes he went out, ran half a block after a horse-car, went home, and had no further trouble.

These conservative hæmorrhages are of frequent occurrence in those suffering from pulmonary fibrosis. Had the man entered the cabinet on the morning of the hæmorrhage, it might have been said that that was the cause of it.

Another case was that of a man, twenty-eight years old, who, about two years before we saw him, had suffered from some acute pulmonary disease. He had never regained his health, but continued weak and short of breath, with recurring febrile attacks which were terminated, each time, by the sudden ejection of from half a pint to a pint of fetid pus. The attacks had been gradually becoming less frequent, and the amounts of pus somewhat smaller, but he continued weak and sick. There had been several severe hæmoptyses.

I took him into the hospital and tried, with the exploring needle, to learn the situation of the abscess-cavity, but was unsuccessful after four deep punctures. The physical signs pointed toward the axillary and posterior portions of the right lung. As it was not accessible by surgical means, we applied the cabinet treatment, using a mild vacuum and spray.

There was a very marked improvement in his general health, the cough abated considerably, and his spirits were greatly improved. On the last day of treatment he appeared in the morning and took the sitting as usual. That night he had a copious hæmorrhage. On the following day there was another. The next day there was no return of it, but on the following afternoon he went out to a restaurant, ate a beefsteak, came home, had another hæmoptysis, and was found dead in his room. At the autopsy, at which Dr. Platt was unable to be present, I found an abscess-cavity, of about the size of a hen's egg, in the posterior part of the lower lobe, at about its middle and close

to the vertebral bodies—inside the projection of the transverse processes. It communicated freely with a bronchus of medium size. The pulmonary tissue in the vicinity was thickened by interstitial inflammation, and there were numerous tubular and fusiform bronchiectases of small caliber. The cavity, adjacent bronchi, and trachea contained blood. The other lung was normal, with the exception of some emphysema of the upper lobe. There was no sign of tubercle.*

There is some question as to whether the hæmorrhage in this case was induced by the cabinet treatment, but, when we consider that he had had several severe attacks previously, and that this one did not occur until from ten to twelve hours after the last sitting, it seems improbable that the treatment could have been the cause of it.

In conclusion, I would say that I regard the cabinet as a valuable addition to our armamentarium. Like every other appliance that is capable of doing good, it is also capable of doing much harm in the hands of ignorant or unskillful persons, and those who control it are certainly under obligations to keep it out of the reach of any but competent physicians.

* See the report of a meeting of the Brooklyn Pathological Society, this *Journal*, May 29, 1886, p. 620.

ON THE PRACTICAL APPLICATION OF
THE PNEUMATIC CABINET.*

BY ISAAC HULL PLATT, M. D., BROOKLYN,

ASSOCIATE PHYSICIAN TO THE DEPARTMENT OF THORACIC DISEASES, ST. MARY'S
HOSPITAL, BROOKLYN, ETC., ETC.

ANY means of treatment which promises relief for such a terrible disease as phthisis is certainly worthy of the fullest attention of the profession. In our fight with this dreadful malady, all we can hope is to gain ground by inches, and the inches gained are well worth the fight they cost. It is with this feeling that we should approach the discussion of the pneumatic cabinet, and not with the expectation of finding a sure and easy cure for consumption. If the apparatus before us promises anything in the way of alleviation of the disease, it is well worthy of our careful notice. This cabinet has been in use three or four years, and the results so far reported are, to say the least, extremely encouraging.

Of course the general principle of the treatment of diseases of the lungs by using air at different pressures is by no means new, the earliest form of appliance being that of the

* Remarks made before the Medical Society of the County of Kings, March 16, 1886.

placed and the air compressed or rarefied at pleasure. I believe it was mainly used for the administration of compressed air, and the treatment by this method was said to increase the vital capacity, reduce the frequency of respiration, increase the consumption of oxygen, and to exercise a general beneficial effect upon the nutritive processes. After this was introduced the well-known Waldenburg apparatus, on the gasometer principle, by which the patient was enabled to breathe from a compressed atmosphere while surrounded by air at the normal pressure, expiration being made, as the apparatus was ordinarily used, into the surrounding atmosphere. Of course there are modifications of these forms, but all worked upon one or the other principle. It seems to me that the cabinet of Dr. Williams and Mr. Ketchum involves a principle which has never been tried systematically before, if at all. It is this: The atmosphere which the patient breathes—that is, which fills his lungs and exerts its pressure upon the intra-thoracic organs, upon the inner surface of the thoracic walls, and upon the upper surface of the diaphragm during such time as the patient is undergoing treatment, and continuously during both inspiration and expiration—is of a different tension from that surrounding the body. This is well designated by Dr. Williams the principle of pneumatic differentiation. It differs from the principle of Tabarie's apparatus in that the latter subjects the patient to the same atmospheric pressure as that of the air which he breathes, and it differs from Waldenburg's apparatus by maintaining the same increased or diminished pressure during both respiratory acts, instead of only one. It is true that this might be accomplished by a combination of two sets of Waldenburg's apparatus, but probably not very conveniently, and I do not know of the attempt ever having been systematically made. Now, it seems evident that the application of this principle will result

pneumatic chamber of Tabarie, which consisted of an air-tight apartment in which a number of patients could be somewhat differently from that of the Waldenburg apparatus, for, while the operation of the latter would be by exerting pressure upon the blood-vessels of the lungs and then suddenly relaxing it, to increase the flow of blood to the lungs, and to increase the active congestion if any existed, the method of Dr. Williams would, if, as I am supposing, the air about the patient be rarefied, exert a steady and uniform pressure upon the vessels of the pulmonary circulation as long as the patient is subjected to the treatment. Now, how will this act? Such portion of the thoracic cavity as is not occupied by tissue—muscular, glandular, the parenchyma of the lung, etc.—consists of air-space and blood-space, and it is obvious that the increase in one of these will tend to the diminution of the other. The respiration of air at the normal tension while the body is immersed in a rarefied atmosphere is in effect the same as the introduction of a compressed atmosphere into the air-space of the lungs; it will increase the air-space and tend to diminish the blood-space, driving a certain portion of the blood from the lungs into the general circulation, which is subjected to a diminished pressure. The pulmonary congestion is diminished in exactly the same way as the congestion of an inflamed joint or of an ulcer by bandaging. Or, to put it another way, the blood is sucked or drawn out from the lungs into the general circulation, as it is sucked into the space beneath a cupping glass.

This I believe to be the main action of the cabinet, the reduction of pulmonary congestion, and the theory is practically verified by our experience with regard to blood-spitting and bronchial hæmorrhage. Time and again patients have come into the office complaining of the sputa being blood-streaked, and, almost without a single exception, the use of

the cabinet has relieved the symptom in the course of a few minutes.

In addition to the effect it has upon the pulmonary congestion, it undoubtedly acts beneficially in other ways. The thoracic gymnastics afforded by expiration against increased resistance will probably be of benefit to the weak-chested. The increased oxygenation of the blood will doubtless improve the nutritive processes. Then the spray, if proper medicaments are used, may be expected to act beneficially upon the accompanying bronchitis. I was not able to follow fully Mr. Ketchum's argument in regard to the condensation of the spray in the deeper air-passages. It occurs to me, though, that our difficulty has been not to cause the condensation of the sprays heretofore used in the medication of the air-passages, but to prevent their condensing too soon. There will be no trouble in making the spray condense if it can once be got where it is wanted; but I have most serious doubts whether it reaches beyond the primary division of the bronchi. Treatment by this method has been spoken of as the antiseptic treatment of phthisis, and by this I suppose is meant that the germs of the disease are supposed to be killed by medicament contained in the spray. In this view I have no faith whatever, but regard it as wholly visionary, and without the slightest foundation either in reason or in fact. Admitting that the *Bacillus tuberculosis* is the one and only cause of the disease, which is not proved; that its destruction will cure the disease, which is still further from being proved; that a small portion of the spray is carried into the alveoli, which is not probable—we are still very far from proving even the possibility of reaching the germs in this manner, for the bacilli, incased as they are in tubercular and caseous masses and in thick mucus, are well protected from even the very minute amount of our disinfectant which we may imagine ourselves able to carry into the deeper air-

passages. The pneumatic cabinet is undoubtedly a most valuable addition to our armamentarium for the treatment of thoracic diseases, but it is too much to expect it to go to the root of the evil, and it must be regarded as an adjunct to, and not as a substitute for, such other means of enabling the patient to fight off the disease as we have at our command.

In regard to the results of the treatment Dr. Westbrook has spoken. Dr. Westbrook and I have used the cabinet about eight months, with about the same kind of results as those reported by Dr. Fox. We are not ready yet to report our cases in detail. Eight months is too short a time to judge of the results of any method of treatment in such a disease as phthisis. A report to be of value should be of a large number of cases extending over a considerable time. So far as our experience goes, it has been very encouraging. One or two cases of advanced phthisis have acted so well that we have strong hopes of the patients' recovery. Patients in the earlier stages of the disease have nearly all experienced some benefit. The exceptions have, I believe, been either those who, easily discouraged, abandoned the treatment before any result could have been expected, or else those who, from the rapid progress of the disease, or on account of the uncontrollable weakness of their digestive powers, or for other reasons, did not seem able to respond to any treatment.

In regard to the dangers which have been spoken of in the discussion, undoubtedly there is some degree of danger, but the danger in the use of anaesthetics does not prevent our use of them. The risk of producing copious or fatal hæmorrhage has been mentioned. Our experience has satisfied us that bronchial hæmorrhage can be stopped by the use of the cabinet. It is hardly conceivable that, with any pressure which one would be apt to use, the lung substance

could be torn. If cavities exist in the lung, the air enters not only the cavities but the surrounding alveoli, so that the walls of the cavities can not be greatly stretched. Of course it is imaginable that a portion of lung might be so far disorganized that an inspiration of greater than usual depth might rupture a vessel—in such cases, for instance, as are described where the vessels lie exposed in the walls of the cavities or stretch across them from side to side, the walls of the arteries themselves being probably disorganized. But such vessels as these would be hardly worth saving, for they would be certain to rupture before long, and the worst that the treatment could do would be to determine the time of the accident. A more real danger I believe to be that of producing emphysema. The lungs can doubtless be seriously injured in this way by an injudicious use of the cabinet; but, by using care in regulating the pressure and watching the condition of the patient's lungs by repeated examinations, this evil can be readily avoided. The results of my experience, however, are opposed to the use of the high pressures advocated by Mr. Ketchum. He spoke of using a pressure of from half an inch to an inch and a half. We commenced the use of the apparatus with pressures varying from half an inch to one inch, but we soon found that the higher pressures unnecessarily exhausted the patient, and in one case produced considerable emphysema. I now seldom use a pressure of more than half an inch, and find the results more satisfactory. Patients in advanced stages of the disease frequently experience great relief to their cough and dyspnœa by this treatment, but its application is subject to the drawback that they are so easily fatigued by the muscular effort necessary for expiration. Dr. Westbrook has suggested that in these cases the valves of the cabinet be so arranged as to take off the pressure during expiration. I have never tried it. It would doubtless

lessen the fatigue, but it would be open to the objection that we should not be getting the benefit of the sustained differential pressure which I believe to be the great feature of this apparatus. I prefer in these cases to meet the difficulty by making the pressure very light and the sittings short.

MEDICAL SOCIETY OF THE COUNTY OF KINGS.

Meeting of March 16, 1886.

The President, Dr. GEORGE R. FOWLER, in the Chair ;

Dr. C. E. DE LA VERGNE, Secretary.

Pneumatic Differentiation and the Pneumatic Cabinet.

—In the continued discussion of Dr. Fox's and Mr. Ketchum's papers, Dr. Brown said that his experience with the cabinet had been embodied in the paper read by Dr. Fox, who, by the way, was unavoidably absent that night, having met with a painful accident. It was evident that accurate diagnoses must precede the application of the treatment, otherwise no proper estimate of its value could be arrived at from results that followed its use.

He thought something ought to be said about the case which was reported as one of chronic interstitial pneumonia or fibroid phthisis. The result in that case was surprising, and was so favorable as to seriously call in question the accuracy of the diagnosis, still he did not think that the result was incompatible with the diagnosis made. The man's clinical history followed very closely the clinical history of fibroid phthisis. He regretted that he did not have the notes of the physical examination. The question was, Could fibroid phthisis be made out at a recoverable stage?

In that form of phthisis—the most chronic form—the inflammation slowly extended from the bronchi to the peri-bronchial

and interlobular connective tissue. An hyperplasia of this took place. Pressure was made upon the lobules. All of them were narrowed. Some of them collapsed. If the collapsed lobules could be distended, and the disease arrested at that point, recovery was possible. While suggesting this as the pulmonary condition at the time treatment was begun, he admitted that there was a good deal of doubt in their minds as to the correctness of the diagnosis, as there was then resonance on percussion. He believed that in reports of cases, especially those intended to exemplify the results of new methods of treatment, there should be entire frankness.

He was not prepared to say to what factor in the operation of the cabinet the favorable results were due—whether to the calisthenic exercise and the introduction of unwonted supplies of air, the influence of the method upon the circulation, the good thus obtained being reflected upon the lung itself, or to the direct application of a remedial agent to diseased areas.

He had then under treatment a young gentleman who had come to him six weeks before saying that he had been to Dr. Janeway, of New York, who had made a diagnosis of tuberculosis. He was referred to the speaker for treatment by Dr. Catlin, who agreed with Dr. Brown in the diagnosis, but an examination of the sputa failed to reveal the presence of bacilli. The young gentleman had an irritable throat, and was unable to bear the spray. It was therefore omitted altogether, and he breathed ordinary air during his treatments, the vacuum being from 0.2 to 0.4 of an inch, and applications were made every other day. His night sweats soon ceased, and had not returned, his appetite improved, and he began to gain in weight. The cough grew less and less troublesome, and now gave him little annoyance. About a week before, the spray was again tried, and was inhaled without trouble. No examination of the chest had been made lately. It might be remarked that this patient had taken cod-liver oil regularly since he came under observation.

From his experience with the cabinet he was compelled to conclude that for bronchitis the treatment was very nearly a specific; in primary infiltration a cure might be confidently

hoped for; in the third stage of phthisis it was likely to add much to the patient's comfort, and in some cases had been followed by a complete cessation of symptoms. In his opinion the cabinet would occupy a high place in the department of preventive medicine. That department had been neglected by the profession.

He believed that a child of phthisical parents, with an ill-developed chest, who would take an occasional treatment in the cabinet, was more likely to overcome the inherited tendency to pulmonary disease than in any other way, or all other ways combined. The treatment seemed to establish a tolerance for cod-liver oil. None of his patients for whom it had been prescribed had been unable to take it and appropriate it. The improvement in nutrition following the applications warranted the expectation that it would prove to be of great service in debilitated conditions generally. Some of his patients asked how many treatments would be necessary. He did not think that a proper estimate of its value in a given case could be made until several treatments had been given, and he usually fixed the number at ten, when, if subjective symptoms had been relieved, he advised patients to continue, being guided thereafter by changes in weight and temperature, in cases of phthisis.

Experience with the cabinet was necessarily limited, and it was impossible to define its sphere of usefulness so early in its history. It was well to be conservative. He thought it was proved that it was a valuable addition to remedial agencies in the management of pulmonary disease; it should be used as such, and not to the exclusion of other well-tried methods.

Dr. WESTBROOK asked Dr. Brown to define the meaning of "primary infiltration."

Dr. BROWN was not prepared to say what was generally understood by the term. In his use of it, it meant the first changes that occurred in a lung the seat of a phthisical process. He did not mean by it tubercular infiltration necessarily.

Dr. WESTBROOK had seen it used in reports of cases.

Dr. EVANS had had no experience with the cabinet, so that he did not know that he could add much by way of its discussion. He had had some experience, however, with voluntary

inflation of the lungs, and with most excellent results. He was very much interested in the paper of Dr. Fox, and especially one part—*i. e.*, out of the thirty four cases of phthisis reported *there were no recoveries!* In an article published by Dr. Williams in the "Medical Record," in 1885, of thirty-three cases reported, ten recovered—quite a discrepancy between these two records which he could not understand. That the apparatus was essentially a compressed-air machine he was satisfied. Dr. Westbrook at the last meeting expressed that as his opinion. Waldenburg's apparatus could be used in various ways, especially the douche apparatus. In a paper by Mr. Ketchum, read before the Section in Practice of the New York Academy of Medicine in December last, in the discussion which followed the paper Dr. De Watteville alleged as the essential difference between the two that the pneumatic cabinet increased the arterial pressure, while Waldenburg's did not. Dr. Putnam Jacobi, in answer to that, said she had taken sphygmographic tracings and found that the arterial pressure *was* increased by Waldenburg's apparatus. There had been very little said about the form of the medicament used. In New York they had been using a preparation of quinine, and bichloride of mercury had been used, and also carbolic acid, iodine, etc. In fact, there had been a great multiplicity of remedies used, and still very little had been said about their influences, so that it did not seem to make very much difference, as far as he could see, what remedy was used in conjunction with pneumatic differentiation. He had used, as he had said, voluntary effort to expand the lung. When one considered that it was possible to increase the tidal volume of air from 20 cubic inches to 255 cubic inches, artificial contrivances seemed to be superfluous. He could himself inspire 255 cubic inches of air by voluntary effort. Mr. Ketchum, in his paper on the physics of pneumatic differentiation, had stated that the residual volume of air was increased from 28 to 40 cubic inches. A child five years of age could inspire 50 cubic inches of air by voluntary effort.

With reference to the conduction of medicament to the air-cells, that had been one of the most difficult obstacles to overcome: in fact, the Academy of Medicine of Paris appointed a

committee to make investigation and determine whether it was possible to carry medicament to the air-cells. As a result, a majority of the committee reported negatively. A few experiments succeeded in throwing the vapor of iodine into the trachea and larynx. The vapor of iodine was one of the most volatile of vapors that existed. If iodine was placed on one side of a plate of gold, the evidence of its presence would be observed on the other side in a short time. He understood that the iodine-test was made in the pneumatic cabinet—*i. e.*, the vapor of iodine was inhaled by a patient who had had an abscess in the lung, and in whom perforation of the chest-wall had resulted; a starch bandage was placed over the opening in the chest and it was discolored characteristically. Now, by means of the voluntary inhalation of iodine on one day, on the next morning the evidence of it would be found in the expiratory air; so that, while he felt that the expansion of the chest and air-cells was important, yet there were other and simpler means of accomplishing it. He could understand, however, that it would be of use in those cases where the patient's respiratory muscular powers were so weak that they were not able to voluntarily expand the lung. He had a case of that kind in his office that very day. He was obliged to give the case up because the patient was unable to expand the lungs. It should be remembered, in introducing medicated sprays in conjunction with compressed air, that the pent-up expiratory volume, the result of reflex antagonism, would be met with in the larynx and trachea. It should also be remembered that the point of meeting was the point of greatest pressure, and that the point of greatest pressure was the point of condensation.

Another thing was the influence of that treatment on temperature. Nothing had been said about that. He would like to ask Dr. Westbrook and Dr. Platt whether they had noticed the influence of pneumatic differentiation on temperature, and also whether they had noticed any more benefit following the use of one medicine than of another.

Dr. WILLIAMS arose to call attention to the remarks of Dr. Evans in regard to statistics of cases quoted.

Dr. EVANS did not wish to cast any reflections upon the sta-

tistics. What he meant was, of the thirty-four cases of phthisis reported by Dr. Fox, no recoveries were noted. Of those reported by Dr. Williams, ten were reported as recovered. He naturally expected to find some uniformity of result when the same means were employed. Hence the use of the word "discrepancy." Whether this difference in result was due to difference in ability to manage the apparatus, or more familiarity with its use, or the different medicines used, he did not know. He did not intend to cast any reflections, however.

Dr. WILLIAMS thought that the doctor meant that they were reporting the same cases, and that there was a discrepancy in the figures reported.

Dr. BROWN said there was also some misunderstanding as to what was meant by the term recoveries. He thought a case should run at least one or two years favorably after treatment and cessation of symptoms. As Dr. Fox had had the treatment but about a year, he did not feel warranted in reporting the cases as "recovered," or any recoveries at all.

Dr. EVANS meant by the term "recovery" a cessation of any symptoms which might lead a man to suppose himself not in health.

Dr. WESTBROOK could not give a more definite answer to the question as to the influence of the cabinet treatment upon temperature than to say that as the patients had improved the temperature had fallen. As a result of his clinical experience, which had included many cases of phthisis, he had come to rely more upon that than upon any other symptom as a sign of improvement. If the temperature fell, and remained down, it was a fair inference that the patient was getting better; that was, that the disease was becoming inactive or "latent." The process of encasement ceased to extend, the inflammatory products on the periphery of the diseased area became converted into fibroid tissue and formed a boundary-line between normal and abnormal lung, and the absorption of ptomaines or other pyrogenous substances ceased. If the general improvement was sufficient to prevent a speedy relapse, the patient might be said to be cured—at any rate, the disease had become temporarily latent. In regard to the relative values of different medic-

ments, he did not know that they could as yet say much. He thought the least satisfactory of all had been the bichloride of mercury. In the strength in which they had used it, 1 to 1,000, it was rather irritating to the respiratory mucous membrane. Then, there was no object in using it, as there were other substances much better suited to the treatment of catarrhal inflammations. As he had already stated at the last meeting, he had no faith in it whatever as a specific treatment, because it would be impossible to apply it by means of the cabinet to the infiltrated lung. They had used a solution of iodine and fluid extract of pine needles on Dr. Fox's recommendation. But perhaps the most satisfactory medicament had been a mixture of carbolic acid and some sodium salt with glycerin and water. For bronchitis, tannin or the mineral astringents were also useful. He thought it would be well if, in the discussion of the subject, more care were exercised in defining some of the terms used. For instance, the word *recovery* had been made use of, particularly by Dr. Williams and Dr. Evans. In using the term it would be advisable to state the meaning attached to it. Again, as to the condition of the lungs. He did not know what was meant by "primary infiltration." He supposed it might mean the first or incipient stage of phthisis, but Dr. Brown stated that he did not refer to tuberculosis. He did not, however, express a belief in the non-tubercular origin of phthisis, so that there was some difficulty in understanding him. He did not wish to criticise Dr. Brown unkindly, but simply used that as an illustration of the somewhat indefinite way in which medical words were often employed. As to the treatment of chronic interstitial pneumonia, or fibroid phthisis, as far as he was acquainted with the art of physical diagnosis, he did not see how it was possible to predicate the existence of that form of disease until there was a growth of fibroid tissue in the lung: and, when that had occurred, there was, as he stated at the last meeting, a firm, solid tissue, with obliteration of air-cells. It was impossible to restore its alveolar structure. He did not think that the process in its early stages was exactly as Dr. Brown had stated it. The inflammation not only invaded the connective tissue between the alveoli and about the bronchial

tubes, but it also involved all the other structures of the lung. The alveoli were filled with proliferating cells, which organized into new connective tissue. The alveoli, alveolar walls, interalveolar and interlobular connective tissues were all fused together into one mass. When that had occurred and the mass was large enough to give rise to dullness on percussion, bronchial breathing, and bronchophony, or to other physical signs equally distinct, a diagnosis could be made of fibroid phthisis; but until that had occurred he did not think that fibroid phthisis could be said to exist. It certainly could not be diagnosticated. There might be a condition of affairs which could be diagnosticated as peri-bronchitis, and from which more or less interstitial fibrosis would subsequently develop, but that, too, would have to reach a considerable degree before it could be recognized. If recovery—that was, a *restitutio ad integrum*—occurred, it would certainly throw a doubt over the diagnosis.

Dr. McCORMICK said that he would like to ask one or two questions, or, rather, refer to a point or two in the use of the cabinet. He was not familiar with its use, and his acquaintance with it extended only to what he had heard and seen at the sessions of the society. He was especially interested in anything pertaining to lung diseases, and had watched with a good deal of interest the discussion in regard to the pneumatic cabinet; but upon one or two points he had failed to receive any light. In regard to the medicinal agents used, he thought that, in the use of these agents, there was such a doubt as to the seat of their action, and the amount of good resulting, that the whole matter was still a question. In the first place, when the structure of the lung was considered, and the care with which nature had protected the air cell for its safety, and the struggle that nature made before she would allow irritating medicines to enter the trachea and through it the air-cells, it seemed to him that great care should also be used by the physician in the application of medicaments.

Vapors might be used which would stimulate the inflamed portion of the lungs, but what would be the effect of those same agents on the healthy lung-tissue? That was a question which ought to be considered well in the use of any kind of

medicinal agents, where we had an instrument of such power as this instrument possessed, and he was surprised that no one had referred to that point.

Another point was that, in the treatment of any inflammatory disease, one of the great remedial agents was rest to the inflamed organ. If we had an inflamed stomach, intestine, or peritoneum, we put it at rest, and hoped by that means to accomplish recovery; but, if we had a diseased lung, we put the patient in the pneumatic cabinet, we employed every means but that of rest to accomplish the desired object. He knew not how this might appear to others, but it struck him as irrational treatment. The instrument might be one of great power in that condition of inertia following inflammatory disease when the inflammatory stage had subsided, but it seemed to him that one of the first and most important therapeutic laws was violated when inflammatory diseases were treated by the cabinet. The vessels already filled with blood were distended, and when the functional activity of an organ was increased it was predisposed to disease. That was illustrated in the diseases of other organs, as, for example, the heart. He had often noticed in phthisical patients who had recovered, that they had been for a long time anemic. The lungs represented the strength of the person afflicted. He did not live up to the standard of health, but to that of disease. If the diseased lung, by the aid of stimulants and tonics, was forced to work up to the full functional capacity of the healthy organ, failure was the result, and the lung went in the direction of degeneration. It would be noticed, as he said before, that patients with phthisis who recovered had been anemic, and the functional work of the lung had been reduced to the minimum, thereby insuring the greatest possible amount of rest to the diseased organ. Just as the quality of the blood in some of these cases was improved beyond a certain point, the danger of a recurrence of the disease and of a fatal termination was increased. This was a therapeutic law in which he had great confidence, and was worth bearing in mind in the treatment of those diseases.

Dr. PLATT was glad that Dr. McCorkle had raised that point. Of course, the principle that an inflamed organ should be given

rest was a sound one; but there must be a reason for it, and the reason probably was that functional activity drew additional blood to the organ, and thus increased the congestion. In the case of the lungs, it was impossible to give them complete rest, for the cessation of respiration meant death. By the method under consideration, however, the usual evil result was avoided, because, instead of drawing blood to the lungs, the tendency was to exsanguinate them, as he (the speaker) had already attempted to show.

Dr. McCorkle said that it was well known that the heart rested from seven to eight hours out of the twenty-four, and that the passive action of the lungs represented that period of rest, so that the lung got a normal amount of rest. It was that period of rest that enabled it to do its functional work. No matter where the organ might be, or what it might do, it must have that rest.

Dr. Westbrook was glad that Dr. McCorkle had asked the questions he did, because they might occur to many general practitioners, and their answer would help to clear up the general subject of aerotherapeutics, as applied with the pneumatic cabinet. In the first place, he would say, in reply to the question whether medicated sprays or vapors thrown into the air-passages might act injuriously upon those parts which were not diseased, that those who were engaged in laryngological work were constantly spraying fluids in that way, and, unless recklessly used, no irritation of the normal membranes resulted. For instance, in treating a catarrhal laryngitis, one would throw a spray into the larynx, but quite a quantity of it would go into the trachea. It did no harm there. The substances generally used were in no way injurious to a healthy membrane—in fact, by cleansing the respiratory mucous membrane, they helped to prevent the occurrence of inflammation as a result of the contact of irritating discharges, particularly in phthisis, and to cure the catarrh when it had already been produced. This washing and disinfection of mucous membranes were considered by many to be of great importance, notably by Professor William H. Thomson, who, in his article on bronchitis, in the first volume of "Wood's Reference Hand-book," placed

great stress upon disinfection as a curative measure. In the second place, in answer to the question whether the increased expansion and labor of breathing were produced by the cabinet as ordinarily employed, that had already been partly answered by Dr. Platt. He would add that the increased mobility of the chest-wall could not be strictly interpreted as increased work put upon the lungs. The lungs were passive organs, expanded under atmospheric pressure, and retracted by virtue of elastic fibers in the parenchyma and walls of the bronchi. While forced expansion would, very probably, have a bad effect on an acutely inflamed parenchyma, which had lost its elasticity and was very friable, it would not so affect a bronchitis; and in chronic diseases the old generalization that diseased organs must have rest did not apply. Many diseased organs were much better for exercise. He would call the president's attention to the benefit obtained by many consumptives who visited great altitudes, where the respiratory activity was necessarily very much increased. The effect of the cabinet in arresting bronchial hæmorrhage was very significant in this connection. Concerning what had been said about the condensation of vapors in the lungs, he would remark that most of the medicaments used were employed in the form of sprays, or nebulized liquids, and not of vapors. Iodine was about the only substance that was vaporized very extensively in the air-passages. Of course, any nebulized fluid would undergo slow evaporation to some extent, but whether reprecipitation would occur was very doubtful, as he was not at all willing to admit the soundness of Mr. Ketchum's opinion in regard to the increase of pressure during expiration. It would be well if Mr. Ketchum could make a calculation of the quantities of the different vapors necessary to saturate the air at a temperature of 100° F. The dew-point might then be determined, and we should have an idea of about how much of any substance it would be necessary to evaporate in order to surcharge the air in the larynx and trachea.

Mr. KETCHUM, in reply, said that he was glad Dr. Westbrook had referred to the term "vapor." The cause of the mist, he thought, which occurred in any change of the hygroscopic condition of the air might be due to either an increased pressure or

a diminished pressure. When there was a passage of water into vapor due to any cause, there was always an intermediate state of mist or fog. If they noticed, the water in the reservoir passed into vapor if the pressure was either decreased or increased. It was the water springing into mist, and then being absorbed by rarefied air into vapor. If, on the contrary, a bladder full of saturated air was suddenly compressed, condensation was effected.

The President called upon Dr. Williams to close the discussion.

Dr. WILLIAMS said that it was known to most of the members that he had been identified with the process which he had christened "pneumatic differentiation," clinical results of which Dr. Fox and Dr. Brown had so carefully recorded that night. In the record of their cases they seemed to describe results rather than denominate them, a course which the speaker heartily commended, on account of the wide difference in the minds of careful men as to what constituted a recovery in phthisis. It had been a pet theory of his that, if they could devise a scheme by which they could certainly mediate the pulmonary tissues, they could manage a large range of cases. His predictions had taken shape in a paper which he had the honor to present to the society some ten years ago. Mr. Ketchum had shown that night that that was possible, and had clearly pointed out the obstacles to be overcome. Now that topical medication was an accomplished fact, it remained for careful discrimination to see that it was advisedly and properly done. Its range was as wide as the materia medica. Vapor, gas, smoke, nebulized spray, and pure air itself, would have their volatiles, but clinical experience alone would decide the comparative value of each. This must necessarily be the most complete when they could obtain the advantages of hospital accommodations. Aside from the value of the pneumatic cabinet as a means of topical application, its range of therapeutic power was perhaps equally great in its direct mechanical effect upon the lungs, and secondarily upon the whole physical economy. It was in that regard that the utmost precaution must be taken. Our lamented Professor Armor, who had been an early and constant adviser, not only in its application, but in the plan by

which it had been placed before the profession, recognized its value and approved the extraordinary precautions which had been taken to guard humanity against its misapplication. Cabinets were at the disposal of all educated physicians, and were at present in the hands of such in almost every prominent city in the Union. Hence they could confidently hope for further and cumulative evidence of its value. The president's remarks plainly showed the necessity of not overtreating cases in which nature had already made a compromised recovery. He would refer the president and all others interested to his early publications upon that subject. In such a condition as the president had described, a thoughtless or over-zealous physician might produce serious, if not permanent, mischief. Happily for them all, there was a time in the history of a phthisical case where the president's remarks did not apply and where over-zeal produced the most satisfactory results. With reference to the influence on temperature, of course in the cases where improvement or recovery took place the temperature declined. There was a class of cases in which, if too much force was applied, the temperature not only would not decline, but would absolutely increase, and that was one of the strongest contra-indications. Relative to the question of compressed and rarefied air, it was apparent that some of the gentlemen who had spoken that night were mistaken in their ideas. It was first necessary to understand the instrument. In the first act—viz., producing rarefaction in the cabinet and allowing the patient to respire against the external air—there was not a particle of compressed air. To be sure, it produced a force, and in that regard only was it similar to Waldenburg's condenser. There the similarity ended, for the physical constitution of the external air had not been changed. But a wider difference yet was produced in the ability to burden the air with moisture or any agent, and to chemically purify it. Through the influence of the rarefied air surrounding the thorax its cubic capacity was so increased that air, with its normal quota of oxygen and natural molecular space, was invited and circulated when no prudent amount of force could drive it. In the second act—i. e., *compression*—we had the condensed air in-

side the cabinet, the patient expiring into the normal atmosphere. The difference between this act and that of expiration into rarefied air was unique. The one was a *vis a tergo* and the other a *vis a fronte*. The third act—viz., alternating from plus to minus the weight of the atmosphere—needed no comment as to its uniqueness or originality. This, more fully carried out, would be resuscitation. It was well for investigators to remember that in treating phthisical cases by that process or by any means which caused patients to frequently present themselves before them, they were making a departure from the usual methods in the management of private cases. Heretofore it had been useless and aimless to make frequent physical examinations. In all recoverable cases they had felt in duty bound to prescribe climatic influence for the major portion of the year. They did not then, as by that process, hear a recital of every varying symptom perhaps daily. Fever came and went; intercurrent inflammations were untreated and unnoted; diarrhœa, night-sweats, and hæmorrhages were combated by the patient's armamentarium, which his careful physician had provided, or were left alone, and at length the season changed or other circumstances compelled or permitted him to return, when they had their first opportunity to observe and examine him. They hoped to find recovery. They sometimes did. But was it not an honest statement that subjective improvement, rather than recovery, was more frequently the basis of their satisfaction? In any event they did not begin to know the exact element in the history of improvement. The cabinet was entitled to equal consideration, though it could not then claim it. It was passing through the crucial test, and its investigators were compelled to meet and treat the inconstant symptoms that arose in every case. Incidental hæmorrhages, colliquative sweat, fever, and every annoying symptom must each in turn stand as its accuser. Happily, in certain cases these symptoms readily disappeared under its use. In others it required more careful study and observation to condemn or exonerate. It was an instrument of great therapeutic range and power. It would be kept and guarded as a professional instrument, and would find a wide and useful place in spite of occasional misapplication.



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